

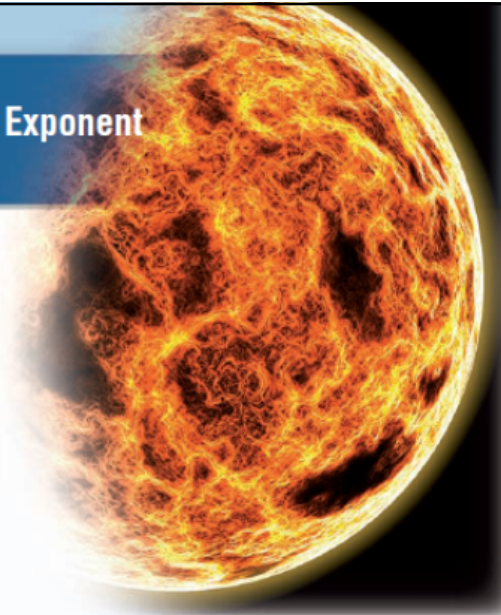
## 2.2

## Powers of Ten and the Zero Exponent

### FOCUS

- Explore patterns and powers of 10 to develop a meaning for the exponent 0.

Nuclear reactions in the core of the sun create solar energy. For these reactions to take place, extreme temperature and pressure are needed. The temperature of the sun's core is about  $10^7$  °C. What is this temperature in millions of degrees Celsius?



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### Connect

We could make a similar table for the powers of any integer base except 0.

So, 1 can be written as any power with exponent 0.

For example,  $1 = 2^0$

$$1 = 13^0$$

$$1 = (-5)^0$$

#### Zero Exponent Law

A power with an integer base, other than 0, and an exponent 0 is equal to 1.

$$n^0 = 1, \quad n \neq 0$$

This table shows decreasing powers of 10.

Number in Words	Standard Form	Power
One billion	1 000 000 000	$10^9$
One hundred million	100 000 000	$10^8$
Ten million	10 000 000	$10^7$
One million	1 000 000	$10^6$
One hundred thousand	100 000	$10^5$
Ten thousand	10 000	$10^4$
One thousand	1 000	$10^3$
One hundred	100	$10^2$
Ten	10	$10^1$
One	1	$10^0$

We use the pattern in the exponents to write 1 as  $10^0$ .

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**Example 1****Evaluating Powers with Exponent Zero**

Evaluate each expression.

a)  $4^0$

b)  $-4^0$

c)  $(-4)^0$

**SOLUTION:**

a)  $4^0$

b)  $-4^0$

c)  $(-4)^0$

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**YOU TRY!**

Evaluate each expression

**SOLUTION:**

a)  $7^0$

b)  $-19^0$

c)  $(-23)^0$

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**Example 2** Writing Numbers Using Powers of Ten

Write 3452 using powers of 10.

**SOLUTION:**

Use a place-value chart.

Thousands	Hundreds	Tens	Ones
3	4	5	2

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**YOU TRY!**

Write 4673 using powers of 10


**SOLUTION:**

Use a place-value chart.

Thousands	Hundreds	Tens	Ones

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### Example 3 Interpreting Numbers in the Media

A brochure titled "Buffalo Tracks" with a red header. It features a black and white illustration of a bison. The text on the brochure includes: "Buffalo Tracks", "Discover and Appreciate the Past", "Head-Smashed-In Buffalo Jump", "A World Heritage Site", "Geography and History", "Archaeology", "History of the Jump", "The Plains Bison", "Hunting Techniques", "The Plains People of Southern Alberta", "Past and Present", "Alberta", and "Canada".

Head-Smashed-In Buffalo Jump is a UNESCO World Heritage Site in Southern Alberta. This site covers 600 hectares and contains cultural remains used in the communal hunting of buffalo. Head-Smashed-In was first used for hunting bison at least 5700 years ago and perhaps as early as 10 000 years ago. It is estimated that close to sixty million Plains Bison roamed the prairies prior to the Europeans' arrival in Western Canada. Less than one hundred years later, fewer than 1000 animals remained.

Use powers of 10 to write each number in the above paragraph.

**SOLUTION:**

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### Discuss the ideas

1. In *Example 1*, why are  $4^0$  and  $(-4)^0$  equal to 1, while  $-4^0$  is equal to  $-1$ ?
2. What is meant by "a power of 10"? Name 6 numbers that are powers of 10.
3. How would you use patterns to explain that  $10^0 = 1$ ?

### Reflect

Why is a power with exponent 0 equal to 1?

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**Practice**

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If Finished in class then attempt these questions

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